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Beekeeping in South Dakota

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(Revised)

BEEKEEPING in South Dakota



Cooperative Extension Service
South Dakota State University
U. S. Department of Agriculture

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BEEKEEPING in South Dakota

By R. J. Walstrom,
B. H. Kantack,
and
W. L. Berndt

Beekeeping has provided many persons with a satisfying and continually interesting hobby. To others it means a profitable sideline easily fitted to a farming or other full-time occupation. The commercial beekeeper finds that this phase of agriculture provides him with an independent and respectable way of making a comfortable living.

The purpose of this bulletin is to provide persons who are interested in starting a few colonies of bees a source of basic information suited to Northern Great Plains conditions.

South Dakota provides the essential natural ingredients for the production of sizeable crops of high quality honey. Honey bees also provide South Dakota farmers and ranchers with vital pollination of alfalfa and other seed crops, the production of which are an important part of the state's agricultural economy.

How to Start

The beginner should usually start with only two or three colonies. This gives him an opportunity to

develop his powers of observation and his handling techniques with a minimum of investment. If one of the colonies should fail to develop normally it can be maintained by transferring brood from a stronger colony to keep the equipment in operation.

Bees and equipment can be obtained in several different ways. The best time to start colonies is in the early spring. New equipment can be obtained, assembled and painted during the winter months, prior to obtaining the bees. Used equipment should also be reworked and repaired before it is needed in the field. Bees should be ordered from producers in the southern states soon after the first of the year for arrival in South Dakota between April 15 and May 1. Bees from these sources are sold by the pound. A three-pound package with a queen is generally found to be the best suited unit for establishing colonies in this area.

Over-wintered or established colonies may also be purchased from a beekeeper in the area. A certificate of inspection issued by the

State Department of Agriculture should be provided by the seller of such colonies and used equipment. This certificate assures the buyer that the bees and equipment have been inspected and are free of infectious bee diseases.

If equipment is available at the proper time, swarms escaped from colonies in the area may be hived to establish new colonies. This procedure is generally undesirable for the beginner because (1) the occurrence of swarms is not a certainty and (2) they often appear too late in the year to store sufficient honey for their own winter needs.

New equipment for starting one colony will cost between \$160 and \$200. A three-pound package of bees and a queen will range from \$20 to \$25 plus shipping charges. Used equipment prices will usually range somewhat less depending on the condition and the need for cleaning and repair. Empty used equipment should be boiled in a lye-water solution for 15 minutes to eliminate possible bee disease problems. A list of dealers in bee supplies and a list of queen and package bee producers may be obtained by contacting the College of Agriculture and Biological Sciences, South Dakota State University, Brookings, South Dakota. The various beekeepers' magazines also carry sections devoted to advertising these sources of equipment and bees.

Colony Organization

Honey bees have four major stages in their development. These stages are the egg, the larva, the pupa, and the adult. The three im-

mature forms all occur in cells in or on the comb and are cared for by the adult bees.

All of the bees found in a hive comprise the unit known as a colony. There are three distinct types or members of bees in each colony. The majority of the bees are workers. A few will be drones, and there is normally only one queen.

The worker bees are the smallest in size. They are sexually undeveloped females. Workers collect the nectar, pollen, water, and propolis needed by the colony. In addition to these many labors outside the hive, they feed the young bees and the queen, process the nectar into honey, secrete wax and build combs, ventilate the hive, regulate the temperature within the hive, and defend the colony, as well as accomplishing many other less essential tasks. Their numbers will vary from a few thousand early in the spring to over 75,000 during the peak of the summer season. Efficient beekeeping will insure maximum numbers of workers at the time the major floral source begins to bloom.

The drone bee is heavy bodied. The large compound eyes meet on the top of its head. The drone is the male member of the colony. He is not equipped with a sting. His only purpose is to mate with the new queen. A few drones are found in all colonies from spring to mid-fall when the workers drive them from the hive to perish. An abundance of drones in a colony indicates that the queen is failing or is lost or that the combs in the brood-rearing portion of the hive are in poor condi-

tion, containing many of the larger drone type cells.

The queen bee is the "egg-laying machine" of the colony. There is normally only one queen in each colony. She has a completely developed female reproductive system. The queen is the largest bee in the colony, having an extremely long abdomen. During the active summer months she is capable of producing over twice her weight in eggs during a 24-hour period. In a sense she is the leader of the colony since her egg laying is essential to the colony's existence. However, she is entirely incapable of caring for the young bees. The queen must be fed continually by worker bees if she is to exist, not to mention produce offspring. A normal queen can lay either fertilized eggs which develop into worker bees or unfertilized eggs from which the drones develop. The queen also develops from a fertilized egg. The cell in which a queen is produced is larger than other cells. It hangs vertically on the side of the comb instead

of horizontally as do the worker and drone cells. The larva in the queen cell is fed special food known as royal jelly. This heavy feeding and extra care allows the queen to develop completely. Sixteen days after the egg is laid in the cell the young queen emerges as an adult. Mating with the drone occurs in flight. Normally the young queen will begin egg laying in from 10 to 14 days after her emergence from the cell. A queen bee will usually live about two years although older queens are not uncommon.

The immature bees in the colony are usually located in the center of the brood chamber in the lower portions of the hive. In a brood comb the tiny white eggs are laid, one to each cell, in ever widening bands. The larval or "white worm" stage also appear in bands as does the pupal stage. The pupal stage is found in the cells closed with light brown wax cappings. Since it takes 21 days for the workers and 24 days for the drones to mature, various stages of development are common-

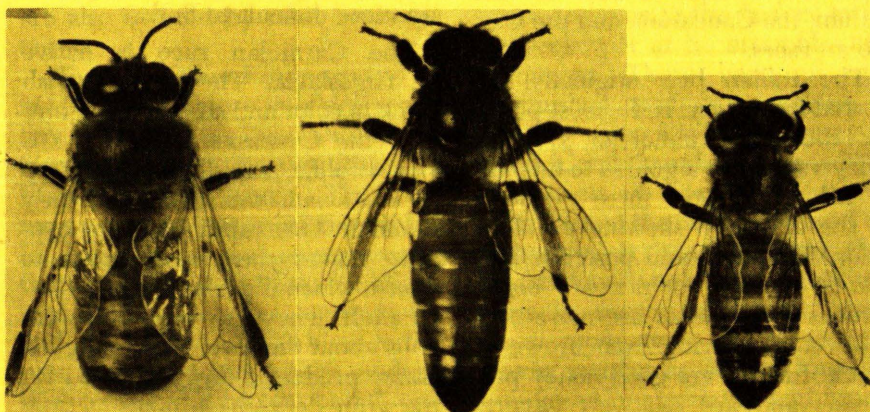


Fig. 1 The occupants of the colony, from left to right: the drone, the queen, and the worker.

ly found in the same comb. Surrounding the brood area is a narrow band of cells filled with pollen used in feeding the larval stages. The pollen may often vary in color from light yellow to dark red depending on its floral sources. Around the edges of the top and sides of the brood comb will be found a small supply of honey which may be covered with a light colored wax capping. The additional honey stores will be placed in combs above the brood-rearing area.

Races of Honey Bees

Honey bees are not native to this country. The different races of bees common to this country are named primarily after their area of origin. Because of importation regulations and the difficulty in controlling the mating of honey bees, it is practically impossible to find pure strains of any particular race of bees in this country at the present time. In addition, bee breeders have developed improved hybrid strains of honey bees by utilizing the better characteristics of the different races. The three major races of bees are the Italian, the Caucasian, and the Carniolan races.

The Italian bee, originally imported from Italy, is the most popular race in commercial apiaries. They vary from a golden to a leather color and have three segments of the abdomen showing a yellow color. The head and posterior segments of the abdomen are black. Drones and queens are more of a solid color varying from brown to black. Italians are good honey producers and are relatively easy to handle. They do not store sufficient honey around the brood area for

winter stores. The beekeeper must place honey in these areas to prepare them for winter. Originally the popularity of this race developed because they could defend the combs against wax moths and were resistant to the disease European Foulbrood.

The Caucasian race originated in Caucasasia. The predominant color is grey with black bands. The drones and queens are usually dark brown to black in color. Caucasians are probably the most gentle bees to handle of the three races — yet they defend their hives well against robber bees. They are good honey producers where extracted honey is desired. This race glues the inner surfaces of the hive and comb surfaces with propolis. This gum-like material makes comb removal difficult and tends to stain the cappings, giving comb honey an apparently soiled appearance. Propolis is extended to the hive entrance in the fall to effectively reduce the size of the opening. Some beekeepers object to the extremely dark color of bees and queens because queens are more difficult to find.

The Carniolan race is native to Yugoslavia. They are grayish black in color and somewhat lighter than the Caucasians. The race is very prolific, rapidly building up populations in the spring and early summer. This rapid build-up capacity makes them very prone to swarm which is perhaps their greatest fault. They use very little propolis about the hive. They are good honey producers and are noted for the white delicate cappings on their combs. This capacity makes their comb honey rate high on the mar-

ket. The difficulty in finding the dark colored queens is a common objection to these bees as well as to the Caucasians. Carniolans are gentle to handle but are somewhat flighty on the combs, tending to mill about when the colony is being worked.

Equipment Needs

Personal Equipment: The beekeeper finds he will need certain pieces of equipment to handle bees. These are the bee veil for protecting his head from stings; the smoker for subduing the bees; and the hive tool used as an aid in prying apart the supers of the hives, scraping away burr comb, and even for driving and pulling nails. In addition to these basic pieces of equipment the beginner may find additional protective clothing advisable. Loose fitting gloves with long gauntlets fitting tightly against the upper sleeve will prevent many stings on the hands and arms. White coveralls with zippered openings are another good clothing aid. Leather boots into which the trouser or coverall cuffs can be tucked are also favored by most beekeepers.

Hive and Other Equipment: The hive is the structure in which a colony of honey bees lives. Our apiary inspection laws require hives to have removable combs. The need for close examination of the combs for bee diseases and colony conditions more than justifies the elimination of apple boxes, log sections, and straw skeps used as hives in the past. The basic parts of the modern hive consist of a bottom board, one or two hive bodies as a brood chamber, and a cover.

The major types of removable frame hives in use today are those utilizing the eight-frame, ten-frame, and the eleven-frame hive bodies. The eight-frame hive bodies have 9 1/8 inch deep frames. This is considered the standard size frame. Ten-frame hive bodies, also known as the Langstroth hive body, will also hold this standard size frame. Jumbo ten-frame hive bodies are available which utilize a frame 11 1/4 inches deep. The eleven-frame hives are known as the Modified Dadant hives. These hives use the 11 1/4 inch deep frames. Most commercial operators use the ten-frame Langstroth type of equipment although some have a preference for one of the other types. The beginner is advised to purchase equipment of one size to eliminate difficulties in interchanging equipment between colonies.

Comb foundation is used in all frames to insure that the completed combs are composed primarily of worker cells and that the combs are fitted smoothly within the frame. Wires are either imbedded in the wax foundation at the factory or by the beekeeper as he assembles the equipment. These wires prevent the finished comb from sagging or breaking when filled with honey or brood. Comb foundation is made of thin sheets of beeswax with the basic form of the cells impressed on both sides. It is available as thin surplus foundation for use without wires in section and bulk comb honey production, and in various heavier weights as well as three-ply foundation in extracting and brood combs. Wax coated plastic foundation is also available.

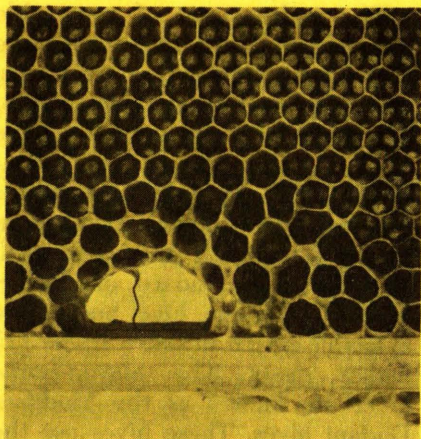


Fig. 2 Close-up view of comb showing larger drone cells between normal worker cells and wooden form bottom bar.

The basic hive unit will use one Jumbo or Modified Dadant hive body or two eight-frame or ten-frame hive bodies for the brood nest. For the storage of honey each hive will need a minimum of four comb honey or bulk comb supers (shallow depth type), or three standard depth (9 1/8 inches) supers for extracting operations.

The bottom board should be treated with a wood preservative to prevent rotting. Cypress lumber is often used in the construction of bottom boards since it is naturally resistant to this form of wood deterioration.

The hive lids or covers may be of all wood construction or of wood covered with metal. The covers using metal are usually of the telescoping type, with the edges hanging down on all four sides of the top body. This type of cover is often used with a thin, wooden, inner-cover to provide an insulating air space for the top of the hive.

Apiary Location

Honey bees are adaptable to a wide range of environmental conditions. However, certain physical features when present in an apiary location will aid the colonies to become more productive and will make the working of those colonies more pleasant.

In South Dakota the ideal apiary site will have a windbreak on the north and west with good exposure to the sun. The slope of the ground should be to the south and east. This ground slope permits cold moist air to drain away from the colonies, thereby improving wintering conditions. By locating his colonies well up on a slope, the beekeeper can avoid losses of bees and equipment due to flash floods. Bees, like other livestock, require a constant supply of water during the warm seasons. The best source of water is a running stream or clear pond within a quarter of a mile of the apiary site. Lacking a natural source, honey bees will take water at stock tanks. While bees do not bother livestock at tanks, they may concern the farmer or rancher. A wooden plank covered

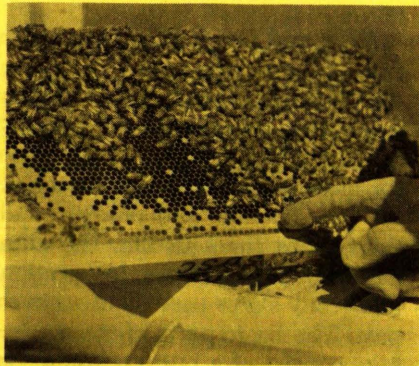


Fig. 3 The queen will normally be found on one of the brood combs.

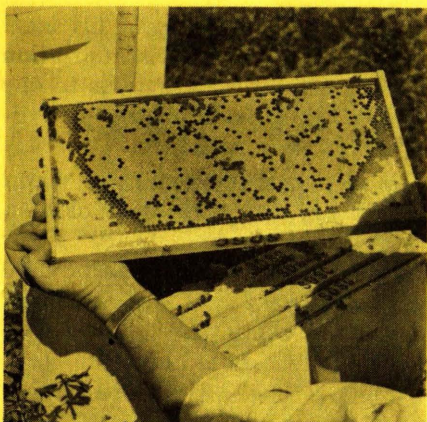


Fig. 4 Brood frame nearly filled with capped cells of bees.

with burlap floating in the tank will aid the bees in obtaining water without drowning. This addition, with permission of the owner, will generally eliminate objections to bees using stock tanks as a watering source. Should no other suitable source of water be available, the keeper should provide his own water. A barrel or tank with a float near the apiary location is ideal, if the water is kept clean and fresh.

Place the hives far enough from the farm or ranch buildings so that the bees are not a hazard to the occupants. The access route to the apiary should pass near or through the farm yard so that the owner will know who enters his land to work the bees. This, plus having the hives within the view of the farm buildings, will aid in preventing possible vandalism or theft.

A written record of apiary locations, kept up-to-date and filed with important papers, provides a record in case of death or injury. "Lost" apiaries are not uncommon when misfortune strikes an operator.

While it is best to locate larger numbers of colonies on farms or ranches, the beginner or hobbyist may desire to keep a few colonies on his home grounds. Honey bees are not objectionable in heavily-populated areas if due precautions are taken. It is important, however, to locate hives so that the bees in flight do not pass through congested areas. A high hedge or fence around the apiary area will cause the bees to fly at above head-height and over passersby. A water supply should also be made available so that bees will not collect at neighboring bird baths and fish pools.

The South Dakota Bee Law has certain requirements pertaining to registration of apiary locations. These are designed to prevent overcrowding of the available bee pasture in any one area. Before establishing apiaries away from home one should contact the State Department of Agriculture at Pierre, South Dakota, for a current copy of the law and regulations.

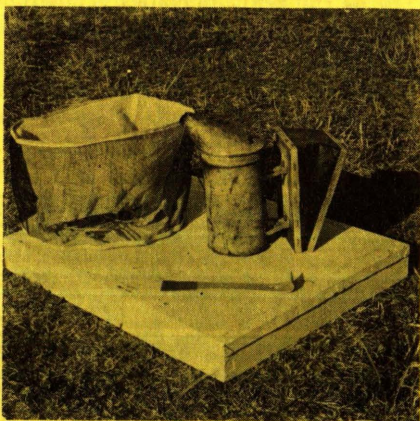


Fig. 5 Basic personal equipment for the beekeeper: the bee veil, the smoker and the hive tool. In addition, the beginner may want bee gloves for extra protection.

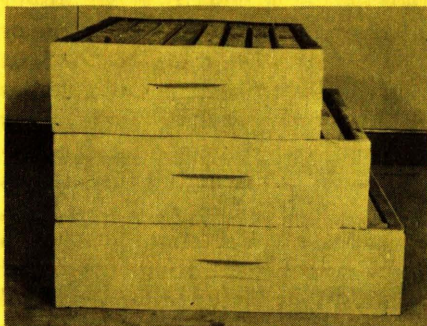


Fig. 6 Relative size of eight-frame, ten frame and Modified Dadant (top to bottom) equipment as shown by shallow extracting supers.

Handling Bees

Before a person becomes too financially involved in beekeeping, he should determine whether he has allergic reactions to bee stings. A bee sting should be scraped from the skin to prevent squeezing the poison into the wound. Normally a sting so handled will cause a local irritation and some degree of swelling. Additional stings should show less swelling as the body becomes accustomed to the reaction. If stings produce respiratory difficulties, unconsciousness, or skin rash the beginner

should seek advice from his local physician about immunization treatments. Severe reactions to one or two stings indicate the inadvisability of keeping bees.

When possible, pick a warm sunny day to work the colonies. Temperatures should be 70° F. or above. Between 10:00 a.m. and 3:00 p.m., the field bees will be most actively working. The colony can be more easily handled between these hours. On cooler days or at other times of the day the bees will be more defensive. Before approaching the hive to be opened, the smoker should be lighted and be producing a good volume of smoke. Burlap or dry rotten wood make excellent fuels.

Standing at the side of the hive, the operator should blow a puff of smoke into the entrance prior to opening the hive. Next, the cover should be pried up about an inch and a puff of smoke forced in this opening. The cover can then be removed. As each super or hive body is removed it too should first be pried up and the crack smoked lightly. To examine the brood nest

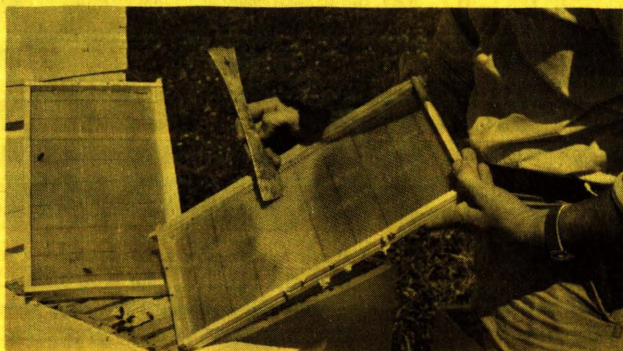


Fig. 7 The wired wax foundation placed in the frames by the beekeeper is soon drawn out by the bees into many individual cells to form a straight comb.

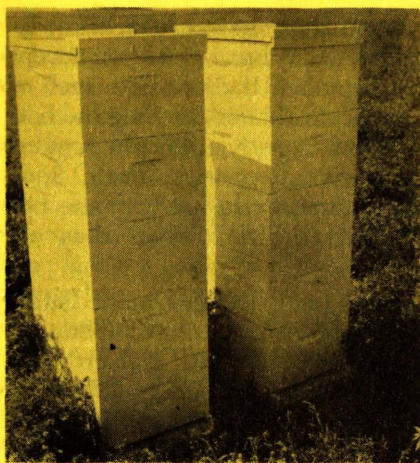


Fig. 8 The beekeeper needs enough equipment to handle the crop as it is collected.

it is best to remove one of the side frames first. Then, by sliding the other frames to the side, frames in the center can easily be removed with little danger of crushing the bees or the queen. As the frames are removed they should be placed on end and leaned against the front of the hive so that if the queen should drop to the ground she will have a better chance of crawling into the entrance of her own hive rather than being lost on the ground. By holding the frame by the top bar and standing so the sun shines over the shoulder, the beekeeper can easily see into the bottom or back of the cells to observe the presence of eggs and young larvae. Having checked the combs in the brood nest for a good brood pattern and young bees, freedom from disease, and adequate stores of honey, the hive should then be carefully reassembled by reversing the order in which the parts were removed.



Fig. 9 The backyard apiary provides recreation and satisfaction for the hobbyist.

During the early spring and in the late summer and fall, colonies may be exposed to robbery by bees of adjacent colonies. To avoid this attack on the exposed honey, the beekeeper should carefully stack the supers being removed on the inverted hive cover and cover the stack with a second cover. Under these conditions the colony should remain open only long enough for essential observations to be made and then it should be quickly restacked and covered. If some robbing has begun during this operation the entrance should be reduced by lightly stuffing the opening with green grass. After a few hours the grass will have wilted and the bees, having reorganized their defenses, will remove it.

The main condition to observe is the presence and effectiveness of the queen. If the queen is not seen, her presence is assured if there are eggs and young larvae in the cells. Take care to prevent crushing of

bees while handling the hive parts. Crushing bees, in addition to possibly killing the queen, will excite the bees, making them more difficult to handle. Moving the hands quickly arouses the bees' natural instinct to attack. Therefore, all movements in removing and replacing frames should be slow and steady. Smoke should be used sparingly when working a colony. When the bees' heads begin to appear between the top bars of the frames in the area being worked, a puff of smoke will be all that is needed to drive them down. Too much smoke will disorganize them and they will begin running about the inside as well as on the outside of the hive. Bees when properly handled will remain quietly on the combs. If too many bees are present on the comb to make a thorough observation of the brood possible, a quick shake of the frame inside the hive or directly in front of the entrance will remove them with the least amount of effort and confusion. Avoid sharp blows on the hive. Such noises are another natural signal for bees to prepare to defend the colony.

Installing Package Bees

There are several effective ways to install bees, received from southern producers, in a hive. One method suited to South Dakota conditions is discussed here as a guide for the beginner.

A few days before the bees are expected, contact the postmaster and request that you be called as soon as the packages arrive. This will speed the delivery and will reduce the amount of time the bees will have to remain in the cages.

Upon their arrival, check for excessive death loss before you accept the shipment. If there is an inch or more of dead bees covering the bottom of a cage, you should request that a claims report be made. Such losses enroute are not common but should be noted when they do occur.

Take the packages immediately to a dark room with a temperature of about 60° F. With a clean paint brush or sprayer, coat the screen surfaces of each package with sugar syrup. It will require approximately one gallon of syrup for each package for this purpose plus feeding the colony upon installation. The syrup should be made of one part granulated sugar and one part water by volume. The bees should be kept in this room until late afternoon when the installation should be made.

For each package, a cover, an inner cover, a bottom board, two empty hive bodies, and six brood frames fitted with foundation will be needed. This equipment should be taken to the future apiary site in readiness for installing the packages.

The first step in installation is to again coat the screens with sugar syrup. Place one hive body on the bottom board and close the entrance to about a one inch opening. Place the six frames in the hive body and arrange with three on each side. Then pry off the wooden cover on the package exposing the bottom of the feeder can and the small wooden queen cage. Carefully remove and examine the queen cage to be sure the queen is alive and in good condition. A quick shake will cause

the bees in the package to drop to the bottom of the cage permitting easy removal of the feeder can. Next, shake about half of the bees into the space left between the six frames. Carefully push three frames from one side over to leave the open space on one side of the hive body. Then place the package with the remaining bees, open side up, in this space. Remove the cardboard cover on the end of the queen cage and thrust a wooden match stick through the candy section of the cage, taking care to avoid injuring the queen. Then place the queen cage, screen side down, across the space between the two center frames and slightly to the rear. Invert the inner cover with the hole open and place on the hive. Fill a gallon can with a friction top lid with the remaining syrup. The can lid should be perforated with about six small holes about the size of a lath nail. With the lid fitted securely, invert the can, holes down, over the opening in the inner cover. Place the second

empty hive body on the hive around this feeder can. Put the cover in place and the installation is complete.

The feeder can should be refilled after three days. The hive itself should not be disturbed for seven days following installation. At that time the queen cage should be checked to be certain that the bees have released her. The empty package should be removed and replaced with frames. The queen should have a patch of brood started in the center areas of the center frames. The feeder should be refilled and kept in use until the honey flow begins. If there is no source of pollen available, the bees should be fed a pollen substitute consisting of one part dried brewers yeast and two parts of expeller-processed soybean flour by weight moistened to a thick dough consistency with sugar syrup. A half pound cake should be pressed over the top bars of the frames just above the brood area.

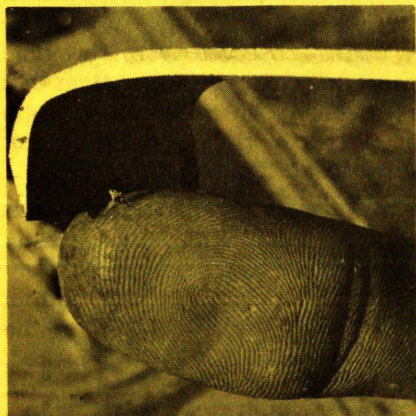


Fig. 10 Bee stings should be quickly scraped, not pulled, from the skin to prevent further injection of poison.

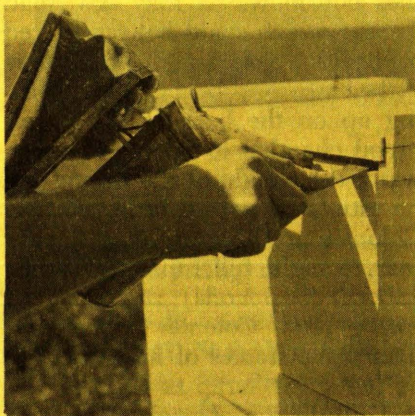


Fig. 11 When opening the hive, apply a puff of smoke beneath the cover before removing it.

Seasonal Management

Spring: Probably the most important time of the year for the beekeeper is the period between the first flight days in the spring and the appearance of the first blossoms of the major floral source. Success depends on the bees increasing their population to capacity before the honey flow. Regardless of whether one's bees are from overwintered colonies, newly established from package bees, or moved in from the southern states as nucleus colonies, the same general requirements exist. These are: adequate food, in the form of honey and pollen; freedom from disease; sufficient space for the brood and new honey stores, and a healthy, vigorous queen.

When colonies are overwintered, they should be checked early in March to be certain that they have survived the winter. Hives in which the bees have died should be closed to make all entrances bee tight in order to prevent robbing by the remaining colonies. A colony which dies out in winter may have had disease which could be transmitted to healthy colonies in the honey picked up by robber bees. By lifting up on the back of the lowest brood chamber to tip the hive forward, the weight of the colony can be estimated with a little practice. Colonies at this time should have four to eight full frames of honey (about 40 pounds) remaining as spring feed. Colonies having less than three frames of honey should be fed sugar syrup as described in the installation of package bees or by using the Boardman feeder or division board feeder.

On the first warm day, when tem-

peratures are 70° F. or above, the colonies should be checked for the presence of a good pattern of brood as evidence of a healthy queen. In mid-April the brood should uniformly cover the center areas of three or four brood combs. Eggs and young larvae (unsealed) should cover at least one comb. Take care not to expose the brood to the cool air any longer than is necessary to check its condition. Incubator temperature in the brood nest is maintained at approximately 94° F. If the brood is permitted to chill during the examination of the hive, it will die. At this time of the year it is also important to replace the combs containing brood to their original location in the center of the brood nest to prevent chilling within the hive. The larval and pupal stages of the brood should be noted on this quick check to determine that the colony is free of brood diseases. The appearance of these diseases will be covered later in this publication. The equivalent of at least two frames full of honey must be present in the hive any time the colony is observed from this time on in the spring. Any less than that amount will cause the bees to begin to decrease their production of young bees.

When the brood area extends over six or eight frames of the top brood chamber it is advisable to reverse it in position with the bottom brood chamber. At this time the black paper wrap can be removed. This reversing of brood chambers places empty combs above the brood for further expansion. In the spring the queen tends to move upward to the warmer portion of the

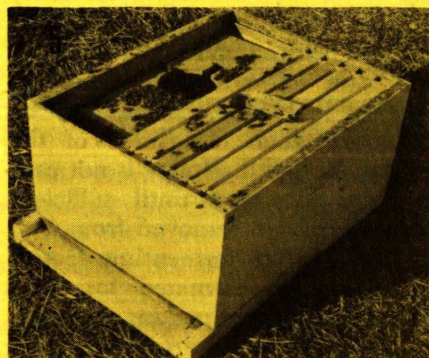
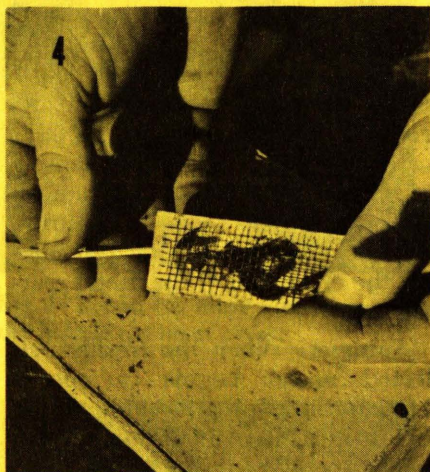
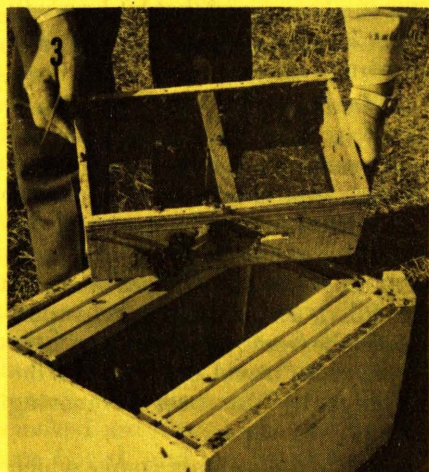
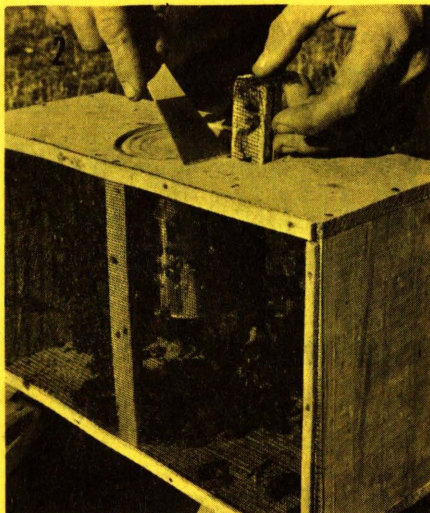
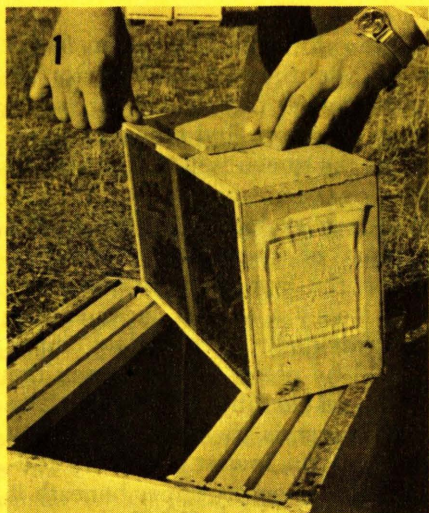


Fig. 12 Following are steps involved in installing a package of bees (1) Remove the opening board from the package. (2) Carefully remove queen cage from package. (3) Shake bees from package into the hive. (4) Prepare an exit hole for the queen by pressing a match stick through the candy supply. (5) This shows the completed installation except for feeding device and cover.

hive. Bees will often attempt to swarm even though there is adequate expansion space if these empty combs are not above the brood nest. This reversing operation offers a good opportunity to clean out any accumulation of dead bees on the bottom board and reset the hive on a firm base for the season.

By checking the colony every 10 days the beekeeper can observe the starting of queen cells as evidence of preparations for swarming. Queen cells in their early stages will appear as cups the size of small acorn husks. These cells have the open side facing downward on the brood comb. In the late larval and pupal stages these cells will have a peanut shell appearance and will be found hanging vertically on the comb. When the brood pattern indicates that the queen is functioning in a satisfactory manner, queen cells in all stages should be destroyed and additional space provided for the expansion of the brood rearing area.

Summer: When the freshly collected nectar begins to appear around the tops and sides of the brood area, it is important to provide supers for the storage of the honey crop. The first super with foundation or empty combs should be placed directly over the top brood chamber. Some beekeepers prefer to use a queen excluder beneath the supers to prevent the queen from laying eggs in the surplus honey area. A queen excluder is a wire or perforated metal device of a size to cover the top of the brood chamber. The perforations or spaces between the wires are just large enough to permit worker bees

to pass through. The queen is too large and thus is confined to the area below the queen excluder. Most operators find that on the average the queen will not move into the upper areas of the hive. The use of queen excluders is primarily a matter of personal preference. When the first super is half filled with honey a second super should be provided. This second super should be placed directly over the top brood chamber and the partially filled super is then moved up. By checking the lowest super and adding another empty super beneath it when it is found half full, the operator can be assured that his bees will never be slowing down due to lack of storage space.

Where comb honey or chunk honey is being produced the empty or partially filled outside frames or sections should be reversed in position with those in the center of the super for uniform filling and capping. As soon as such types of combs are filled and capped the supers should be removed from the bees to prevent "travel staining" of the cappings by the bees in moving through the super.

Early in the summer combs which are to be used for extracted honey production should be completely capped before removal. In late summer and fall when the nectar is coming in slower, combs may be removed when two-thirds of the cells are capped. Honey is not capped by the bees until sufficient water has been removed from it to prevent it from fermenting. Honey removed and extracted too soon will often ferment making it unsuitable for commercial purposes.

Honey can be removed from the colonies in several ways. A heavy, ash-free smoke can be applied with a smoker to drive the bees down and out of the honey supers. Where only one or two hives are involved, a fine bristled brush may be used to sweep the bees from each comb. Most commercial producers of extracted honey use a fume board for honey removal. This "board" consists of a structure the size of an inverted inner cover, covered with black painted metal or tarpaper. It is lined with one or two layers of muslin which, when in operation, are sprinkled with liquid bee repellent. These boards are placed on top of the super or supers to be removed. Heat absorbed by the dark top area increases the repellent action which drives the bees down into the lower areas of the hive. Best results are obtained on warm, sunny days. Producers of honey for market in the comb often use an "escape board" which is an inner cover equipped with a bee escape device, permitting the bees to move out of the honey super but preventing them from returning. Supers to be removed are placed above the "escape board" and are removed, free of bees, two days later. The important factor in the use of this method is to be sure that there are no openings in the honey supers through which robber bees can enter after the colony bees have been removed.

Fall: During the latter part of September the colonies should be checked for stores, a good queen, and possible disease. Colonies to be overwintered will require approximately 60 pounds of honey or 1½ standard depth hive bodies filled



Fig. 13 Nail holes in the feeder can lid, permit bees to suck syrup from the inverted can.

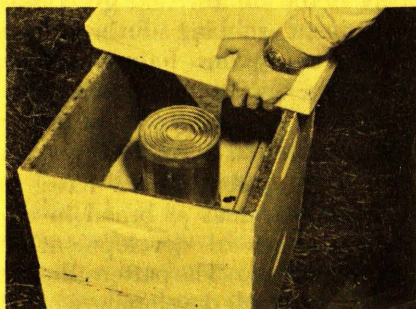


Fig. 14 Feeder can filled with syrup over the hole in the inner cover.

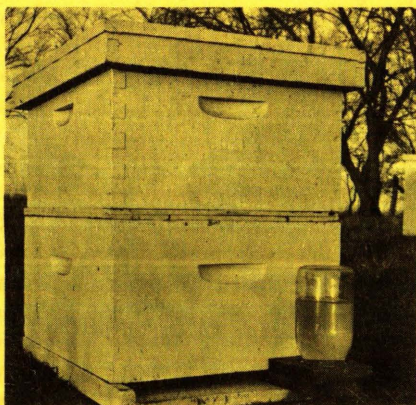


Fig. 15 Boardman feeder installed in hive entrance.

with honey in addition to the equivalent of 2 or 3 frames of pollen. Under normal conditions the pollen will be found in adequate amounts in the lower brood chamber so the beekeeper's chief concern will be with the honey supply.

If insufficient amounts of honey are available, a heavy sugar syrup composed of two parts granulated sugar and one part hot water can be fed. Fall feeding should be accomplished early enough in the season so that the bees will have warm days to move the syrup to storage space in the combs. Take great care to prevent robbing during these feeding operations. Late afternoon timing on this activity is desirable. Entrances should be reduced in size as an additional precaution.

A good queen should have at least three frames of brood in the various stages of development at this time of year. The pattern should be uniform with developing worker bees. Scattered cells containing brood or cells showing more than one egg are evidence of a poor or

lost queen. Some worker bees have the ability to lay eggs in the absence of a queen. These eggs will develop only drones and the cells producing them will project above the other cells giving a "bullet nose" appearance to the cell. Colonies with poor queens or laying workers should be checked for disease and killed. The dead bees should then be shaken from the combs and the equipment stored in a bee-tight, unheated building until bees can be reestablished in the hive the following spring.

When checking the brood for the presence of a good queen, the beekeeper should always look for brood cells in which the young bees have died. Such cells when found are usually evidence of the presence of disease in the colony. This will be discussed under the section of bee diseases.

One of the successful methods of managing bees in South Dakota utilizes the practice of packing bee colonies for winter protection. This procedure basically involves wrap-

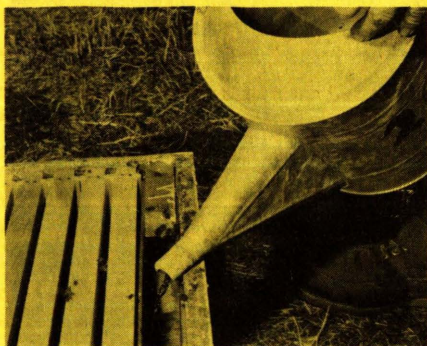


Fig. 16 The division board feeder is easily refilled with syrup.

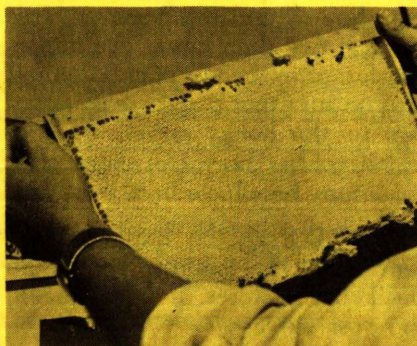


Fig. 17 Honey when fully capped is ready for extracting.

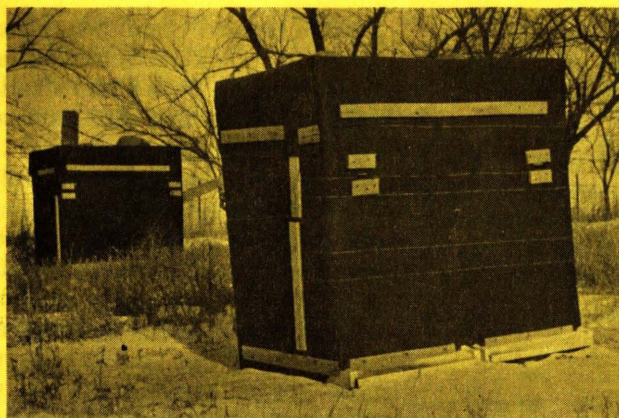


Fig. 18 Colonies are prepared for winter by wrapping them in tar paper. Top entrances are provided as shown between the two wooden blocks.

ping the hives in black weather-proof material such as tarred felt roofing paper. Black corrugated cardboard boxes to cover individual hives are also available on the market. Such a wrap provides a certain amount of wind protection as well as a heat absorbing surface for the hive. One layer of paper is usually considered adequate. Colonies are wrapped separately or in pairs. The paper may be held in place with lath strips nailed over the overlapping paper edges or by tying them down with baler twine. An additional piece of the paper material may be placed over the top of the hive or hives or the top edges may be folded in and held in place with the covers. The bottom entrance to each hive is closed with lath stripping or an entrance block. Top entrances are provided which also aid in the removal of moisture from the hive. This is usually accomplished by boring a one-half inch hole just below the front hand hold in the top super or food chamber. This opening is extended through the wrapping paper. A short piece of lath tacked on either side of this top en-

trance will prevent the paper from tearing at this location.

Other sound management methods in use in South Dakota include wintering the colonies in specially prepared cellars or killing the bees in the fall and starting again with package bees in the spring. Both of these methods provide the beekeeper with more honey in the fall but also involve more expense for cellars, packages, and usually labor.

Winter: If the colonies have been properly prepared for winter, the beekeeper's activities in the apiary during the winter months can be limited to an occasional check on warm days. Colonies found dead in winter should be tightly closed to prevent robbing by the bees from other colonies.

Supers of comb are best stored during the winter by stacking them in an unheated building. The stacks should be on a solid floor and covered to prevent mice and bees from entering. Such stacks should be checked about once a month during prolonged warm weather in the fall and after the temperatures are above freezing in the spring for the

presence of the wax moth. Ethylene dibromide used as described under wax moth control will kill all stages of this pest.

The winter months provide the beekeeper with a good opportunity to repair, replace, or increase his equipment so that all will be in readiness for the coming season's needs.

Handling of Honey

Extracted Honey: Most honey is marketed as a liquid in cans, drums, or bottles. Care must be taken to avoid contaminating the honey during the harvesting and processing stages. Filled supers should be covered while enroute from the apiary to the extracting plant. Temperatures in the extracting room should be kept at 85° F. for the best results. The first step involves using a heated knife or other uncapping device to cut away the capping on the comb. Combs are then placed in an extractor which whirls the honey from the cells by centrifugal force. Honey from the extractor should be strained through a 40-mesh cloth and then permitted to settle for at least 24 hours to permit the fine air bubbles to rise to the surface. When the honey is to be marketed on a wholesale basis in cans or drums, it can be drained from the settling tank at this stage. If the honey is to be bottled or packaged for sale directly to the consumer, it should be slowly and uniformly heated in a water bath to 160° F. This temperature should be maintained for 30 minutes and then the honey should be bottled and cooled. This heating process prevents the granulation of the honey.

Section Honey: Comb honey produced in the pound sections requires special attention. Such honey should always be stored in a dry room at temperatures ranging from 80° to 85° F. The wooden sections should be carefully scraped to remove any stains or particles of propolis. Sections should be graded as by weight and completeness of cappings. The most satisfactory packaging material is a cellophane or other transparent type of bag. Section honey, as well as all honey to be sold in the comb, should be stored so that the stacks can be fumigated about every seven days to prevent damage by the wax moth. Carbon disulfide is commonly used as a fumigant for this purpose. This material is highly inflammable and should be used with care.

Bulk Comb or Chunk Honey: This type of honey is produced in the shallow wireless frames on light foundation. It is marketed in the frame; cut from the frame and packaged; or cut into chunks and placed in bottles which are then filled with liquid honey. The same general handling and storage conditions as mentioned for section honey apply here. When it is cut from the frame to be packed in cellophane containers, the comb is permitted to drain thoroughly by placing it on screen racks. Comb to be bottled with liquid honey need not be drained in this manner.

Beeswax: The cappings from the extracting process and the trimmings from cut comb or chunk honey operations contain a considerable amount of honey. Where only a small amount of this material occurs it will suffice to mash it

and spread it over a screen or hardware cloth support to let the honey drain out overnight. Larger operators may whirl the cappings dry in an extractor or press it dry in a wax press. Some may use a capping melter which melts the wax and separates it from the honey.

Once the honey has been removed from the cappings or trimmings this material can be placed in a burlap bag and submerged in boiling water to release the wax. The heat for such purposes should be from a steam source to prevent fire due to wax boiling over onto the flame of an open fire. Pressure on the bag containing the wax residue will release even more wax. The liquid wax will rise to the surface where it can be skimmed off and poured into molds where it can solidify.

Diseases of Honey Bees

Both the larval and adult forms of the honey bee are susceptible to diseases. These diseases affect only bees and present no hazard to the beekeeper or to persons eating honey or handling materials produced by diseased bees. Bee diseases affect only a very small percent of the colonies in South Dakota. Apiary inspectors employed by the State Department of Agriculture at Pierre, S. D., provide considerable service to the beekeeping industry every year by detecting and eradicating bee diseases. It will be highly advisable for the beginning beekeeper to notify the state apiary inspector of the location of his colonies and request an inspection and a copy of the South Dakota Bee Law. In addition to checking colonies for diseases the inspector is a source of timely information on apiary management.

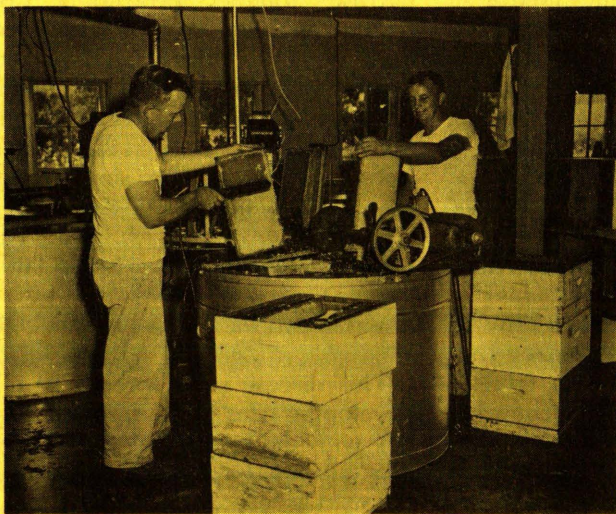


Fig. 19 Uncapping combs of honey during commercial extracting operations. (Photo: South Dakota State Department of Agriculture)



Fig. 20 State apiary inspectors aid beekeeper by detecting and controlling bee diseases as well as providing timely management suggestions for the beginner. (Photo: South Dakota Department of Agriculture)

DISEASES OF THE BROOD:

These diseases attack the larval and pupal stages of the honey bee. The gross symptoms in all cases involve the finding of dead bees in these stages in their cells in various degrees of decomposition. When checking for bee diseases, shake the bees from the comb and hold it so that the rays of the sun pass over your shoulder to illuminate the bottoms of the cells. The residue of any dead brood will usually be found in this area of the cells.

American Foulbrood (AFB) is caused by a spore forming type of bacteria, *Bacillus larvae* White. It is the most serious disease affecting honey bees in this country. This disease is transferred from colony to colony in most cases by honey robbed from diseased colonies, feeding diseased honey, and use of contaminated equipment on healthy colonies. Since this disease attacks both the larval and pupal stages, the im-

mature bees in these stages will appear dark brown in the bottom of the cells. The cappings over such cells will usually be depressed and may be completely or partially removed by the bees in the colony. Those bees dying in the pupal stage will often show the mouthpart's narrow "tongue" protruding upward. The early stages of decay are quite gummy. A match stick placed into the mass in the cell will, when withdrawn, cause the decaying material to string out an inch or more before breaking. This simple test, plus the presence of a distinct offensive odor, will usually be sufficient for a diagnosis in the apiary. In later stages the mass in the cells dries down to form a hard, shiny scale.

This disease soon spreads to all developing bees in the infected colony with the result that the colony dies out due to its failure to replace the worker force.

Treatment: The most certain method of eradicating American Foulbrood is known as the burning method. This involves killing all bees in the diseased colony; burning all the combs and dead bees in a pit 18 inches deep; scorching the interior portions of the hive bodies, supers, lids and bottom boards; and making a thorough check to see that all bees and residue are completely covered in the pit. The burning method is best accomplished in late evening when there is no danger of robber bees from other colonies coming in contact with the diseased material. With new frames and foundation the equipment will again be ready for use.

Other methods of treatment include using various antibiotics such as terramycin. For the latest information on the use of these materials contact the State Department of Agriculture, Pierre, S. D. or the College of Agriculture and Biological Sciences, South Dakota State University, Brookings, S. D.

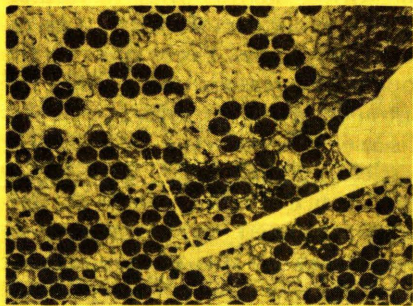


Fig. 21 Dead brood, caused by the American Foulbrood organism, will string out when tested with a match stick. Note the many sunken cell cappings and perforated cappings.

A safe procedure to prevent disease in your colonies is to never buy or borrow used bee equipment unless it is officially certified to have come from disease-free colonies or has been thoroughly decontaminated. Much equipment found in disuse is the result of American Foulbrood having caused the death of the bees. *Bacillus larvae* White, in its spore form, can cause this disease any time bees are re-established in such equipment.

European Foulbrood: This brood disease is also caused by a bacterium, *Streptococcus pluton*. This disease affects only the larvae stage of the developing bee. The cells containing dead larvae may or may not be sealed. Cappings of sealed brood will be discolored and shrunk or punctured. The decaying larva will have a yellow or grayish brown color and emits a sour, yeasty odor. The decaying larva is rather rubbery. The match stick will show that the mass cannot string to

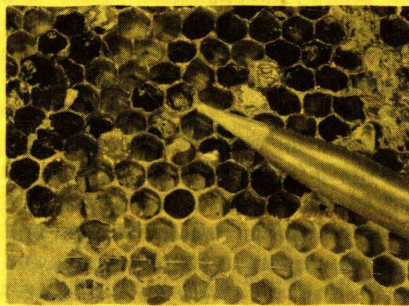


Fig. 22 Sacbrood is evidenced by dead larvae appearing as watery sacs in the cells.

the extent found in American Foulbrood conditions. In later stages of decay the dead larvae will take the form of a dry, flat or twisted scale on the bottom surface of the cell. This scale is not tightly adhered to the cell and in most cases will be removed by the worker bees.

Treatment: Most cases of European Foulbrood can be corrected by killing the old queen and replacing her with a young healthy queen from a southern bee breeder. Italian queens have shown their progeny to be somewhat resistant to the disease.

In a few areas a somewhat more virulent form has apparently been present which has resisted the clean-up efforts of the bees. Certain antibiotics have shown good results in treating such cases. Contact the State Department of Agriculture or South Dakota State University for methods of treating such cases should you encounter such a problem.

Sacbrood: This disease of the brood of honey bees attacks the larval stage. Its causative agent is a filtrable virus which causes the degeneration of the digestive tract. Sacbrood is usually present in the hive only in the spring of the year, disappearing with the occurrence of the main honey flow. The diseased larvae usually occur in capped cells. These cappings will be sunken and often have one or two holes chewed in them. The dead larva changes from white to brown starting at the head. The head end will usually be turned up from the bottom surface of the cell. A match stick inserted into the mass will easily remove the

entire larva as a watery sac-like structure in its early stages of deterioration. Later stages will be easily removed as a loose brown scale.

Treatment: In most cases the bees will clean out the diseased cells during the early stages of the honey flow. Severely weakened colonies might well be requeened with a new queen of the Italian race. Italian bees are generally considered to be somewhat resistant to Sacbrood.

DISEASES OF ADULT HONEY BEES:

Certain diseases attack only the adult bees of the colony. Such diseased bees can be detected due to their unusual movements in the hive or their inability to fly outside of the hive.

Nosema Disease: Nosema disease affects adult worker and queen bees most severely during the winter and spring months. It is caused by a one-celled organism known as *Nosema apis* which attacks the digestive tract. Diseased bees confined for long periods of time during the winter months often have difficulty getting out of the hive to relieve themselves. Feces spots on the tops of the frames and around the entrance are often evidence of this disease. The infected bees appear restless and take on a dark greasy appearance. Colonies may be seriously depleted in population or even killed by this disease. Recent investigations show that package bees as well as overwintered bees may be heavily infected. Infected queens are usually superseded during the normal spring build-up period.

Treatment: Carefully selected apiary locations which permit the bees to fly as frequently as weather will permit during the winter months will reduce the effects of this disease. Well ripened honey stores and a flowing source of water are also valuable aids in reducing infection. The use of fumagillin fed in a syrup to the colonies in early spring has been shown to control this disease by eliminating the *Nosema* organism from the digestive tracts of the bees.

Paralysis: This disease of adult bees is probably due to various organisms. One type has been determined to be caused by a virus. Bees affected by this disease will be found as in a stupor. Healthy bees will be seen to tug at those diseased. The loss of hairs is common on the sick bees giving them a shiny appearance. They will often be found crawling about the inside corners of the hive. Other cases have shown them to crawl away from the hive where they die in a few hours to several days.

Treatment: There is no known treatment for this disease. Requeening may be of some value.

Bee Poisoning

Honey bees may be poisoned by two methods. Certain plants produce nectar which has a lethal effect on bees. Chemicals when improperly applied to crops and range land for the control of injurious insects may also cause the death of honey bees. For the most part poisonous plants are not a factor in bee losses in South Dakota.

Colonies affected by chemical applications will usually show many

dead bees outside the hive entrance. Poisoned bees inside the hive will be very flighty and will usually be attacked by the normal bees. Colonies will show rapid decreases in the number of field bees. Poisoning usually occurs when crop areas such as orchards, or alfalfa and sweet clover fields are treated with insecticides while the crop is in bloom. Some cases of poisoning are caused by the drifting of applied insecticides from the treated area over the apiary.

Most insecticides used today kill the adult bees before the poisonous materials can be stored in the hive or fed to the developing bees. Therefore, the hive parts and honey are usually not contaminated and can be reused without danger of continued losses.

Herbicides or chemicals used to kill weeds have not been found to be poisonous to honey bees. The use of these materials does reduce the amount of flowering plants producing nectar flows. This method of weed control is relatively inexpensive when compared to mowing and cultivation practices and can be expected to continue to reduce roadside sources of pollen and nectar.

Chemical poisoning of honey bees cannot be cured so the beekeeper should look to methods of preventing its occurrence. A close check into the agricultural practices in the area for a two mile radius surrounding an apiary is advisable. Where insecticides are to be applied to orchards or legumes it is often helpful to check with the operator who will be applying the chemicals. Advise him of the presence of your bees in the area and of the value of

their pollinating activities in the production of his seed or fruit crop. Proper timing of insecticides requires that the applications be made before the plants bloom or after the petals have fallen. Such applications give the best control of injurious insects and do not harm honey bees. If chemicals are required during the bloom period request that the operator notify you prior to applying them. You can either move your bees or screen them during the spraying operations.

Enemies of Bees

Wax Moth: The wax moth, *Galleria mellonella* (L.), in its larval stage feeds on pollen and wax. The larvae or "worms" break down the combs by feeding and tunneling. The webbing, excretions, and cocoons they produce create a mass of useless trash in unprotected stacks of combs and weak colonies.

Control: Again, prevention is the essential part of control. Equipment should be stored in tight stacks in unheated buildings during the winter months. Combs in storage when temperatures are above 70° F. should be fumigated and checked every three weeks for possible infestation. Ethylene dibromide shows the best results of the fumigants tested. One tablespoonful of this liquid material placed on a small cloth pad on top of a stack of eight full depth supers and covered with a flat lid will kill all stages of the wax moth. Fumes of this material should not be inhaled.

Weak colonies in an apiary should be watched carefully for the presence of wax moth. Nucleus colonies for holding or mating queens

are often susceptible. Good management practices usually include killing poor queens in weak colonies and uniting with strong colonies.

Mice and Shrews: Mice will often invade stacks of equipment containing combs. Both mice and shrews will invade colonies during the winter months. The shrews feed on the bees and mice feed on the pollen and sometimes on the honey. Both damage the combs by chewing and nesting.

Control: Stacking equipment in storage with tight covers and bottoms will eliminate mouse damage. Closing the hive entrances to one-half inch openings will prevent the entry of these pests during the winter months. When the bees are active they will defend the hive and repel these invaders.

Ants: These insects will sometimes nest on the inner covers of the hives during the summer months. The bees will prevent this nesting if the hole in the inner cover is left open. Soil nesting ants creating mounds in the apiary can be eliminated by treating the surface of the mound with insecticides.

Skunks: Skunks may visit the colonies during the winter months. They scratch on the entrance area of the hive, causing the bees to break from the cluster. The skunks consume the bees as they appear at the entrance to investigate the disturbance. Trapping or the use of poisoned eggs in the apiary will usually control these pests.

Bees as Pollinators

The honey bee is often considered only as a producer of surplus

honey and beeswax. These activities are actually only minor functions of the insect when compared to the value of its role as a pollinator of over 50 agricultural crops. The production of seed or fruit from these crops depends on the transmission of pollen by insects. Since native or wild pollinating insects are steadily decreasing in numbers, the importance of the honey bee becomes greater each year.

In South Dakota the major field crops requiring insect pollination for seed production are alfalfa and sweet clover. While certain native

bees are more efficient pollinators, the honey bee is an insect which can be moved to the crops in sufficient numbers to fulfill the pollination requirements. Best pollination for a particular field is obtained by placing the colonies on the field. Up to four colonies per acre are desirable for maximum seed set on alfalfa; however, any concentration of bees over one colony per acre usually shows a decrease in the honey yield per colony. Where these larger numbers of colonies are desired by the grower, arrangements to compensate the beekeeper for decreased honey returns are advisable.



Fig. 23 Wax moths can completely destroy unprotected combs. TOP: Wax moth larvae directly in front of pointer. Cocoons are shown to the left and moths to the right. BOTTOM: Webbing, cocoons and comb destruction of the wax moth.

EC 565 (revised)
Beekeeping in South Dakota

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